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# **THE NATIONAL SHIPBUILDING RESEARCH PROGRAM**

## **Proceedings of the REAPS Technical Symposium**

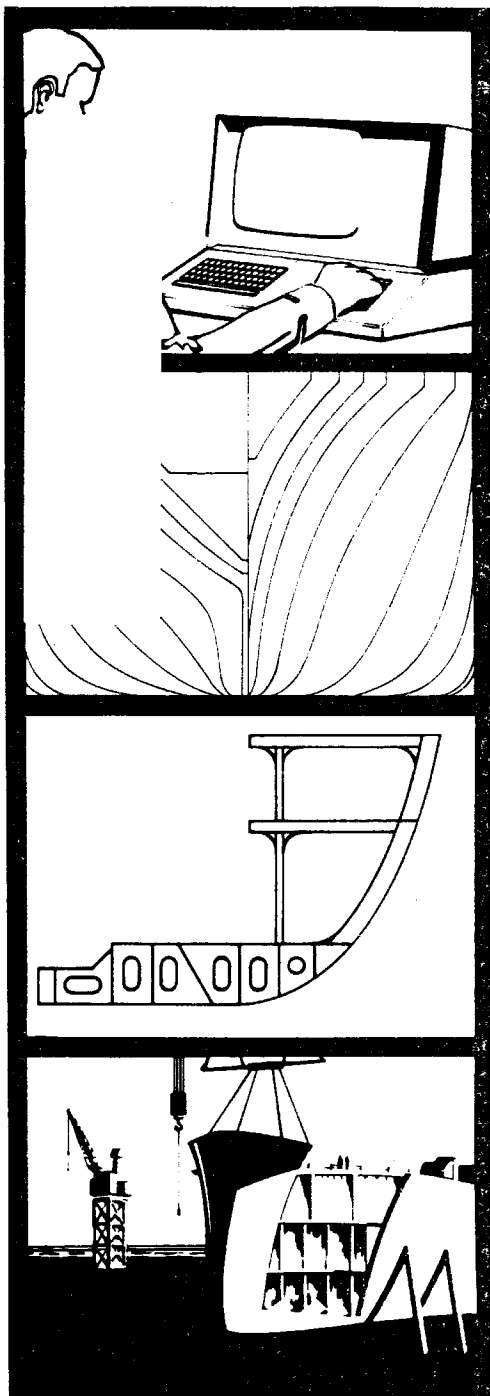
### **Paper No. 1: The REAPS Program -- Progress and Prospects**

U.S. DEPARTMENT OF THE NAVY  
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THE REAPS PROGRAM --  
PROGRESS AND PROSPECTS

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## INTRODUCTION

The origins of the REAPS Program and its evolution since 1974 have been reported upon quite thoroughly in this forum in the past, so I will not retrace that ground here. For the benefit of those who may not be familiar with REAPS, -- its objectives and workings -- however, let me briefly review these in their current context.

## THE PROGRAM

REAPS today is a shipbuilding industry/government (MarAd) cooperative development program aimed at improving shipyard productivity through the development and implementation of computer and manufacturing aids for shipbuilding. The program is organized as an element of The National Shipbuilding Research Program, which is administered by the Ship Production Committee of the Society of Naval Architects and Marine Engineers.

The program itself is organized as follows. The most important group within the program is the REAPS Representatives. These are the participating shipyard personnel from production management, the loft and design who make the program work. At meetings of the Representatives, MarAd and the Program Manager (held four to five times yearly), the Representatives jointly identify problem areas of mutual concern, discuss alternative solution strategies and formulate development project descriptions and implementation plans. An interested member may then formulate a project proposal which is then again critically reviewed by the group before it is endorsed as a recommended project for submission to MarAd. An integral part of each such proposal is a

forecast of the savings or benefits to be obtained as a result of the development, usually on a per ship basis.

If the proposal is accepted by MarAd, a cost sharing contract is issued to the yard. Under this arrangement, MarAd pays the yard's direct costs on the project, while the yard itself financially participates in the project by forgoing its overhead and profit.

Once a project is initiated, a Project Advisory Group is formed consisting of member yard personnel and, on occasion, personnel from non-member yards, who will have direct responsibility for the use of or performance of the development once installed in their yard.

As the name implies, the function of these groups is to advise the shipyard contractor on technical and operational considerations and capabilities concerning the development to ensure that the delivered product meets industry-wide requirements, not just those of the yard developer.

During development, the Representatives are continually apprised of the project's progress and any problems that may arise. The objective here is to be alert to any "mid-course corrections" that may be either necessary or desirable in order to insure that development's ultimate implementation success.

The final, and most important, phase of this process is implementation. Depending on the nature of the development itself, this step may consist of simply using the prototype in production in the yard in which it was developed and providing workshops and technical information and specifications to the industry. This might-be the case for a computer program. For a prototype piece of manufacturing hardware, however, the developer might solicit machine builders

to produce the piece of gear, providing all necessary design drawings, specifications, etc. It is one of the Program Manager's jobs to ensure that these developments receive industry-wide exposure and that the means of acquiring and using them are provided.

The Program Manager (IITRI) provides a number of other services in support of this basic development process including:

- Providing the Representatives with reports on technology from allied industries of potential use in the yard.
- Providing a number of technical information services (including this conference) in order to keep the Representatives (and the industry at large) abreast of new developments.
- Chairing and handling the logistics and details of Advisory Group meetings and Representatives meetings.
- Carrying out, or managing, development projects as directed by the Representatives.
- - Providing manufacturing and computer related technical support to the member yards.

## PROGRESS

The Program, as described in the foregoing, has been operating since last August, although many of the development projects currently underway were begun earlier. One way of gauging the progress of the program to date is to examine the projects currently underway and those about to begin.



- Pipe Detailing System

The function of this system, being developed by Newport News Shipbuilding, is to reduce pipe detailing and fabrication labor costs. The system itself contains a minicomputer system and up to four user stations, each consisting of a digitizer, a CRT graphic display, a keyboard, and an alphanumeric display for prompting messages. The users of the system will be able to digitize details from composites or arrangement drawings approximately twice as fast as the manual detailing process. The output of the system will be complete pipe shop work packages including a shop drawing, a material list and bending instructions. The system is slated for delivery in March, 1978,

- Damaged Stability Program

**Bethlehem Steel Corporation's Sparrows Point yard is currently developing a comprehensive damaged stability analysis program for** ship-like and arbitrary forms, such as drilling rigs and drydocks. The user will be able to specify conditions of damage and compartment geometries in a number of convenient ways and direct the program to perform any one of several damaged condition analyses. This project will be complete in September of this year.

- Hull Definition Fairing Program

The object of this project, being carried out by Newport News and a contractor, CADCOM, Inc., is to adapt the Navy-developed Hull Definition Fairing program to commercial use and assess its performance benefits over those fairing programs currently in use. The delivery of the program was made in May of this year to MarAd. After a test and evaluation period at Newport News, the program will be

delivered to the industry, along with a training workshop, in September of this year.

- Graphics and Communications Terminal

This project entailed the design and specification of a computer terminal for simultaneously processing remote job entry (RJE) Communications and N/C verification graphics on either a CRT or a drafting machine. The design and specification as well as a significant portion of the software for this system is complete. One of the REAPS yards is currently processing a procurement request for the terminal's minicomputer system and has the drafting machine in house.

- Parts Definition System

The goal of this project is to design a minicomputer-based system for use by the loftsman in interactively defining, reviewing and editing part geometries; The system is designed to alleviate the problems faced in many lofts of loss of skilled loftsman, the difficulty in training new loftsman in the use of parts programming language, and long job turn-around times at some installations for batch parts programming runs.

This project is scheduled for completion in August of this year by Newport News. If the projected economics of the use of such a system prove attractive, the development of the system will follow.

- Cold Twist Forming of Structural Shapes

The objective of this project, being carried out by IITRI's Metals Division, is to design and build tooling to perform the twisting of

shapes in a conventional hydraulic press. Conventional twisting of furnace shapes is currently one of the most grueling and labor intensive jobs in the yard. The use of the fixtures and dies with a hydraulic press will allow a much smaller crew to twist shapes, with up to 36 inch deep webs, much more productively.

A one-fifth scale prototype set of tooling is currently being fabricated at IITRI and will be tested to determine the feasibility of the process for different materials, the need for local line heating, etc., before fabrication of the full scale tooling,

#### ●Steel Marking Device

The marking of steel shapes and parts with piece identification information is currently a tedious, manual process wherein hand-held character stamps are hammered into the material, leaving the character impressions. An alternative to this manual method for N/C cut parts is to use the burning machine's center punch to bang out the character patterns of the piece ID. But this method is slow, tying up the entire machine during the marking process thus reducing steel throughput. In addition it is hard on the center punch itself.

The purpose, then, of this project is to come up with a cost effective marking tool, suitable for the retrofitting of existing burning machines, which can mark alphanumeric ID information at a sufficiently high speed that the throughput of the burning machine is not noticeably degraded.

IITRI is currently investigating the costs and throughput characteristics of several devices. Among these are rotating carousel of characters and pneumatic punch (a device consisting of a set of

character wheels , and a simple, inexpensive end mill or router tool]. The device found to be most effective in terms of cost/performance will then be developed and retrofitted to an existing machine for test and evaluation.

In the near future, the following additional projects will be started:

- **Sheet Metal Template Software**

The purpose of this project is to eliminate the need for manual sheet metal layout work through the development of a series of software subroutines to compute the geometry of sheet metal layout templates for most of the commonly encountered duct intersection and transition piece cases in yard sheet metal work. It is estimated that 80% of the templates currently developed manually will be handled automatically via this software, saving in excess of 10,000 man hours per new design.

- **Computer Aided Cost Estimating**

The goal of this project is to develop a rational approach to yard cost estimating which can be implemented on a computer. A computer program will be developed, which will produce a material list and associated labor content by ship module (e.g., hull, main propulsion, auxiliary machinery, etc.). This information will be organized within the framework of a particular yard's cost group system. It will be useful in negotiating a new construction contract or for playing the "what if" game with potential owners in analyzing the cost effects of varying certain preliminary design input parameters. The program is expected to reduce estimating man hours and to improve the reliability of estimates.

As I think you can see from this list of projects, the REAPS program is involved in the cooperative solution of a variety of problems spanning yard processes from preliminary design to steel fabrication. We expect this technical diversity in REAPS-sponsored projects to continue in the future.

These projects in fact represent progress made by REAPS in many technical areas. But the REAPS program and its group of Representatives, has made progress in other equally important areas. The following is a list, necessarily incomplete, of some of the more important ones.

- People - As I mentioned earlier, the shipyard Representatives are the key to the program's success or failure. REAPS has succeeded in involving a group of the best technical personnel in the industry in a joint problem-solving process which has become very effective. Their expertise spans most facets of design and construction, computer technology and manufacturing technology, bringing to bear a unique set of capabilities on the various project areas.
- Communication - The establishment of open communications between yards is crucial if common problems are to be identified and attacked cooperatively. The REAPS yard Representatives have made enormous progress in opening up the channels of communication between yards on operational and technical topics. Technical discussions between yard Representatives are now wide-ranging, informal and highly constructive. This free flow of technical experience is in reality the foundation of the program on which is constructed the solutions to individual problems identified by the group.

## ●Mechanics of Operation

The REAPS group has overcome most of the organizational and logistic obstacles which can act to impair the effectiveness, on a technical level, of a program like REAPS. The group has, for example, gotten used to the process of formulating and initiating development projects, and to the process of technically monitoring these projects as a group. The REAPS yards, in addition, have overcome some early difficulties in executing cost-shared contracts with the Maritime Administration, and vice-versa.

In short, the group operates fairly smoothly, allowing the vast majority of its time and energy to be expended on the solution of technical, not organizational, problems.

## ●Perception of Government Involvement

The perception of the government within the shipbuilding industry as being the regulator, or worse, the meddler, is a long-standing one. Whether or not this perception ever was a significant problem for REAPS is debatable. But what REAPS and, indeed, all of the operating components of the National Shipbuilding Research Program have shown is that the government can play a constructive role within the industry by providing a positive stimulus to the shipyards to bring about the technological improvements the industry itself wants.

## PROSPECTS

Based on the foregoing, I think you will agree that the prospects for success of the REAPS program in the future are excellent. The program has assembled a highly qualified group of shipyard technical personnel who have an understanding both of the problems and the technology available for use in their solution,

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An informal, productive environment has been established within which these people can work to accomplish their common objectives. And finally, vehicles have been established for initiating development projects, for insuring that the developments themselves meet industry requirements, and for implementing and integrating these developments smoothly into the yards. In short, all the necessary "pieces" are there.

As necessary as these features are, however, they are not sufficient to guarantee future success. The REAPS group must continue to work to identify new opportunities for productivity improvement and to capitalize on rapidly evolving technologies in order to continue to produce cost effective solutions to productivity problems.

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